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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/699,067	10/31/2003	Dhruva Ranjan Chakrabarti	200312985-1	1366

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FORT COLLINS, CO 80527-2400

EXAMINER
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STEELMAN, MARY J

ART UNIT	PAPER NUMBER
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2191

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	02/08/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

**Office Action Summary**

Application No.

10/699,067

Applicant(s)

CHAKRABARTI ET AL.

Examiner

Mary J. Steelman

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 31 October 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-17 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-17 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 31 October 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)  | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date <u>10/31/2003</u> . | 6) <input type="checkbox"/> Other: _____  |

### **DETAILED ACTION**

1. Claims 1-17 are pending.

#### ***Information Disclosure Statement***

2. IDS received 10/31/2003 has been considered.

#### ***Claim Rejections - 35 USC § 101***

3. 35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

Claims 9-16 are rejected under 35 U.S.C. 101 because claim limitations are directed towards software per se. The claimed invention is directed to non-statutory subject matter. Apparatus claims fail to recite any hardware features required enabling the functionality.

#### ***Claim Rejections - 35 USC § 103***

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made

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5. Claims 1-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent 5,740,443 to Carini, in view of US Patent 7,146,606 B2 to Mitchell et al.

Per claims 1, 9, and 17:

A method to dynamically generate an inline transformation order for call sites independent of an inline analysis order, wherein the method uses an inline affinity graph and an edge dependence graph.

Carini disclosed (col. 6: 23-34, locality and dependence considerations for inline analysis.

Carini disclosed (col. 6: 13) cross file inlining, determined by Interprocedural Analysis and construction of a call graph (col. 7: 50-51), and a calculation of a 'routine cost function' and a 'call site cost function' to characterize the suitability of each call site for inlining.

The 'inline transformation order' is made by (col. 9: 1-2) a backwards walk of the interprocedural analysis of the program control graph.

While Carini did disclose a control flow graph, annotated with information, he failed to explicitly recite an inline affinity graph and an edge dependence graph.

However, Mitchell disclosed (col. 2: 42-49) an intermediate representation format that can accommodate annotations by threading control flow and data flow graphs through the intermediate representation. Col. 9: 42-49, annotating the IR. Separate data structures may be desired in some instances. Col. 10: 46-47, links are made from branches...to destinations. Col.

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10: 57-58, 61-64, more than one path to a label is possible, multiple links can be represented.

Control flow can be explicitly represented and expressed in the intermediate representation.

Therefore, it would have been obvious, to one of ordinary skill in the art, at the time of the invention, to modify Carini, using the teaching of Mitchell because (Mitchell, col. 2: 2-10) optimal use of computing resources may be obtained by analyzing or transforming the software. Intermediate representations make code easier to analyze.

Per claims 2 and 10:

A method of compiling a computer program from a plurality of files of source code, the method comprising:

- an inline analysis to determine which call sites in the plurality of files to inline;

Carini: col. 6: 14, inlining of procedures which are in different source files for the call sites that invoke them, col. 6: 17-34, compiler implemented method for performing selective automatic procedure integration over a program call graph...col. 7: 42-43, both intra-file and inter-file cross file inlining and cloning are supported.

- an inline transformation to perform said inlining within currently opened files, wherein the inline transformation includes determining which files to open and close in dependence on an affinity weighting between the files.

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Carini: col. 8: 1, Routine cost function include measurements of the size of the procedure, complexity, number of calls, and number of I/O calls (opening and closing files).

Per claims 3 and 11:

-affinity weightings are representable by an inline affinity graph whose nodes correspond to files and whose edges correspond to inlines across corresponding files.

Carini: Col. 7: 53-66, The compilation model provides an IPA collection phase during which each procedure in the program is visited and the IPA inputs are collected...a routine cost function to characterize the suitability of each procedure for inlining and a call site cost function to characterize the suitability of each call site for inlining., col. 8: 9-15, construction the program call graph, inlining inputs are collected and an intermediate representation is generated.

Per claims 4 and 12:

-the affinity weightings between files depend at least upon the number of inlines between the files.

Carini: Col. 8:1, col. 10: 47, Each outgoing edge of each procedure is visited...inlining is performed on edges that have been marked 'INLINE and the corresponding call sites within the procedure are removed.

Per claims 5 and 13:

-dynamically updating the inline affinity graph after inlinings within currently opened files are done.

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Carini: Col. 8:1, col. 10: 47, Each outgoing edge of each procedure is visited...inlining is performed on edges that have been marked 'INLINE and the corresponding call sites within the procedure are removed. (dynamically updating), col. 9: 10, Perform optimizations and transformations.

Per claims 6 and 14:

-an inline dependence for a call site is maintained including information as to a set of call sites that the call site depends upon.

Carini: Col. 10: 16 & 24-29, each procedure is visited, measurements of the size of the procedure, complexity, number of calls, and number of I/O calls for each procedure.

Per claims 7 and 15:

-inline dependencies are representable by an inline dependence graph.

Carini: col. 7: 49-60, Collect the Interprocedural Analysis (IPA) inputs. Construct the program call graph (PCG). Perform a reverse topological traversal of the PCG...intermediate representation of the procedure...Also collected and saved during this phase are the inlining and cloning inputs...

Per claims 8 and 16:

-dynamically updating the inline dependence graph after inlinings within currently opened files are done.

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Carini: col. 9: 10, Perform optimizations and transformations.

*Conclusion*

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mary Steelman, whose telephone number is (571) 272-3704. The examiner can normally be reached Monday through Thursday, from 7:00 AM to 5:30 PM. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wei Zhen can be reached at (571) 272-3708. The fax phone number for the organization where this application or proceeding is assigned: 571-273-8300.

Any inquiry of a general nature or relating to the status of this application should be directed to the TC 2100 Group receptionist: 571-272-2100.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Mary Steelman



01/30/2007